

Claims

1. Semiconductor structure consisting of at least one first material region (1) and a second material region (3), wherein the second material region (3) epitaxially surrounds the first material region (1) and forms an interface (2),
5 characterized in that
the materials of the first and of the second material regions (1, 3) and/ or their dimensions and/ or their dopings are such that a Fermi-level-pinning (9) is observed at the epitaxial interface (4)
10 of the second material region (3) situate opposite to the interface (2) of both material region (1, 3) and that the first material region (1) forms a quantum well for free charge carriers.

2. Semiconductor structure of at least one first material region (1) and a second material region (3), wherein the
15 ~~second material region (3) epitaxially surrounds the first material region (1) and forms an interface (2),~~
characterized in that
Fermi-level-pinning (9) is observed at the non-epitaxial interface (4) of the second material region (3) situated opposite to the
20 interface (2) of both material regions (1, 3) and that the first material region (1) forms a quantum well for free charge carriers.

3. The semiconductor structure according to claim 2, characterized in that

the Fermi-Level-Pinning (9) is determined by the choice of the material and/ or the dimensions and/ or the doping and or the doping profile of one or both material regions (1, 3).

4. The semiconductor structure according to one of the preceding claims,
characterized in that
on the second material region (3) a further material region (5) is epitaxially provided, such that Fermi-Level-Pinning is only present at the nonepitaxial interface (6) opposite to the epitaxial interface (4) between the second and the further material region (3, 5).

5. The semiconductor structure according to one of the preceding claims,
characterized in that
the first material region (1) has a dimension a of less than 100 nanometers in x -position, especially of 0.5 to 50 nanometers.

6. The semiconductor structure according to one of the preceding claims,
characterized in that
the shortest distance of the quantum well to the nonepitaxial interface (4, 6) where the Fermi-Level-Pinning is observed does not fall below the size of the depletion length d .

7. The semiconductor structure according to one of the preceding claims,
characterized by
a material for the further material region (5) which is identical
5 to the material of the first material region (1).

8. The semiconductor structure according to one of the preceding claims,
characterized in that
a metal is used as material for the further material region (5).

10 9. The semiconductor structure according to one of the preceding claims,
characterized in that
the materials of the first and of the second material regions (1,
3) show quasi lattice matching and are provided dislocation-free to
15 each other.

10. The semiconductor structure according to one of the preceding claims,
characterized by
 $\text{Al}_y\text{Ga}_{1-y}\text{As}$ and $\text{Al}_x\text{Ga}_{1-x}\text{As}$ as materials for the first or respectively
20 second material region (1, 3) with $x > y$ for the formation of a
step in the quantum well (band discontinuity).

11. The semiconductor structure according to one of the preceding claims, wherein there is a concentration of free charge

carriers of at least 10^{10} cm^3 , particularly of at least 10^{16} cm^3 in the first material region (1).

12. The semiconductor structure according to one of the preceding claims,

5 characterized in that

it comprises, at least partially, metal (Schottky) electrodes (7) with gate function for the control of the charge carriers.

13. A transistor, laser, resonant tunnel diode or other hetero structure comprising a semiconductor structure according to
10 one of the preceding claims 1 to 12.

NEW CLAIM

1. Semiconductor structure consisting of at least one first material region (1) and a second material region (3), wherein the second material region (3) epitaxially surrounds the first material region (1) and forms an interface (2), the materials of the first and of the second material regions (1, 3) and/ or their dimensions and/ or their dopings being such that a Fermi-level-pinning (9) is observed at the epitaxial interface (4) of the second material region (3) situate opposite to the interface (2) of both material region (1,3) and that the first material region (1) forms a quantum well for free charge carriers, characterized in that the second material region (3) has several clamp-like surfaces provided epitaxially to each other.